

SPATIAL AND TEMPORAL DISTRIBUTION OF BENTHIC OLIGOGHAETA IN EUPHRATES RIVER, MIDILLOF IRAQ

Haifa J. Jaweir¹, Jasim M. Salman^{2*}, Zahraa H. Abaid³

¹Department of Biology, College of Science for Women, University of Baghdad, Baghdad, Iraq.

^{2*} Department of Biology, College of Science, University of Babylon, Hilla, Iraq.

³ Ministry of Science & Technology, Baghdad, Iraq.

*Email: jasimsalman67@yahoo.com

To cite this article:

Jaweir *et al.*, SPATIAL AND TEMPORAL DISTRIBUTION OF BENTHIC OLIGOGHAETA IN EUPHRATES RIVER, MIDILLOF IRAQ, *Mesopotamia Environmental Journal*, 2014, Vol. 1, No. 1, pp. 1-8.

Abstract: The present study discusses spatial and temporal distribution of aquatic oligochaetes community as sorted from macrobenthic fauna collected during River Euphrates in Iraq. Extending from Al-Musayab district (S1), Saddat Al-Hindiah district (S2) to Al-Hindiah district (S3).

Twelve species of oligochaetes (9 genera; 3 families) were determined during study period. Highest individual number were recorded in S3 (9954.56 ind./m²) during Jan. 2014 and the lowest number were recorded in S3 (222.2 ind./m²) during Oct. 2013. The highest average monthly density was recorded during Dec. 2013 and Jan 2014, while the highest site average density was recorded in S3.

Tubificid worms made up the majority component of aquatic oligochaeta in investigated area of the river specially *Limnodrilus* spp. which include four species *Limnodrilus hoffmeisteri* (Claparede 1862), *L. claparedeians* (Ratzal 1869), *L. profundicola* (Verrill, 1871), *L. udekemianus* (Claparede 1862). *Stylaria lacustris* was the most abundant Naidid worms.

This study recorded two species as new records on Euphrates river {*Spirosperma ferox* (Eisen, 1879), *Pristina jenkiniae* (Stephenson, 1931)} and one species as new record on Iraqi fauna {*Bothrioneuron pyrhum* (Marcus, 1842)}.

Keywords; Aquatic Oligochaeta; Tubificid worms, Naidid worms; Naidinae, Pristininae, diversity, River Euphrates,

1. Introduction

Oligochaetes are the most divergent and abundant group of benthic invertebrates in freshwater system [1]. They are (especially the tubificid worms) important as primary consumers, primary decomposers, modifiers of the substrate, and as food for predators [2].

The distribution and abundance of oligochaetes in fresh waters depend upon many environmental factors, such as the nature of the substrate, temperature, flow rate, oxygen concentration and availability of nutrients, moss or algae cover, and changes in nitrogen, carbon, and humus contents in the bottom sediments [3,4]. Several authors considered oligochaetes as good indicators of environmental variations because of easy sampling and identification, relatively long life; limited migration and have different sensitivities to polluted water [5,6].

Oligochaetes are hermaphrodite and reproduce by cross-fertilization, while a few species of them may reproduce asexually by architomy or paratomy [7]. Their identification to species level depends on some external morphological features, among these; the color of the body, number of segment, size, shape and number of chaetae, or on the anatomy of digestive and reproduction systems as well as some features concerning their movement pattern and habitat nature [8].

Several authors in Iraq were studied the oligochaetes in many Iraqi aquatic systems [9, 10, 11, 12, 13, 14] and [15] in addition to some studies which referred to oligochaetes as a group within the macrobenthic community samples [16, 17, 18].

The objective of the present work is to determine the spatial and temporal distribution of aquatic oligochaetes species in Euphrates river in middle of Iraq.

2. Materials and Methods

Samples were collected monthly from three sites on River Euphrates in the middle region of Iraq including, (S1) at Al-Musayab district; (S2) at Saddat Al-Hindiya city and (S3) at Al-Hindiya city (fig.1).

Ekman dredge (15X15cm) has been used to collect Surface bottom sediments samples during the study period from October 2013 to June 2014. Three random replicates, were washed with water through 0.2 μ m mesh size sieves in the field and then brought to the laboratory. In the large worms, like Tubificid worms were easily sorted with the aid of a magnifier using a white tray for spreading sediment during sorting. For sorting smaller micobenthos worms, like Naidid worms, small amount of sediments were transferred to a clean Petri dish containing little amount of tap water, and the worms sorted carefully using dissecting microscope. Sorted worms were placed in a watch glass containing little amount of clean tap water, few drops of 4 % formalin was then added drop by drop to the dish to kill the worms. The worms were then preserved in 75% ethanol. For the purpose of identification, the preserved worms were transferred to 30 % alcohol, left for few minute before they transferred to distilled water. A temporary slides were prepared by adding a drop of polyvinyl lactophenol on a microscopic slide and then immersed the worms. The cover slip was added and gently pressed. The slides were left for few days before examined under a compound microscope. Species identification was conducted using appropriate keys [19;7].

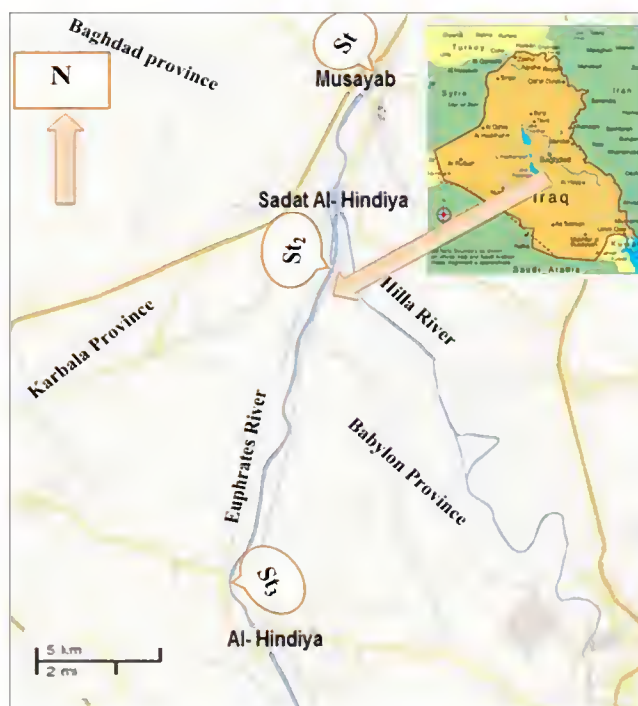


Fig. 1. Map of the study area in the mid sector of River Euphrates, Iraq

3. Results and Discussion

Table 1 shows the total densities of aquatic oligochaetes during the study period, it was noted that they were present at all sites and in all months. The highest monthly average density of 7066.04 and 7465.90 ind/m² were recorded during Dec. 2013 and Jan. 2014 respectively, while the highest average site density of 4809.418 was recorded in S3. The lowest monthly average density of 503.65 ind/m² were recorded during Oct 2014, and lowest site average density of 2676.28 ind/m² were recorded in S2. Fig(1) shows that Tubificid worms comprised 91% of total numbers of oligochaetes, in which *Eiseniella tetrahedral* and Naidid worms comprised only 6 & 3% respectively.

A total of 2436 individuals represented 12 species were sorted during the study period. Eleven species were belonging to the family Naididae, three of them identified as Naidid worms (2 species Naidinae + 1 species Pristininae) ; 8 species of Tubificid worms, in addition to one species of family Lumbricidae. It is clear from this table that *Limnodrilus hoffmeisteri* was the most abundant species with 49.55% of the total oligochaetes individuals identified , Followed by, *L. profundicola* and *Branchiure sowerbyi*, which they recorded a percentage of 19.34 % and 18.08% respectively , while other species recorded percentages ranged from 4.66 -1.20% . Highest species richness was recorded in S1, S3 (10 species each) , while at S2 the number of species did not exceed 7 .

Fig (2) shows that naidid worms were represented by *Stylaria lacustris* (78%) *Pristinella jenkiniae* (16%) and *Slavina appendiculata* (6%). Among Tubificid worms, Fig (3) shows that, *L.hoffmeisteri* had a higher percentage of 55% , followed by , *L. Profundicola* and *B. sowerbyi* (21%) each. Other species includes *L. udekemianus*, *L. claparedeianus* , *Tubifex tubifex*, *Spirosperma ferox*, and *Bothrioneurum pyrrhum*. All of them form 3% of total Tubificid .

The occurrence, abundance, diversity, and density of aquatic Oligochaetes were highly affected by variation of environmental features such as heavy metals pollution [20] ; prevalence of gravelly sediment [21] ; low availability of organic matter [22] and competition and predation [23] and [4]

The high density of Tubificidae in study sites may be indicated to the entrance of organic matter into the aquatic system [4] . The abundance of oligochaetes may be due to several reasons such as high organic content and dissolved oxygen concentrations [24].

Some authors such as [25] and [26] used the counts of oligochaete to classify of water pollution levels : 100 to 999 individuals (light pollution) ; 1000-5000 individuals, (moderate pollution) and exceeding 5000 individuals(heavy pollution) . From this point of view, the state of pollution in the River Euphrates is considered as moderately polluted to heavy pollution as about 10000 ind/ m² was recorded in S3, due to decrease in degradation rates in cold temperature during Dec.2013 and Jan. 2014 .

The results showed by Fig(1) indicates that the ratio of Naididae to Tubificidae was too low. This ratio was used by some authors as bioindicator of water quality in respect to environmental factors [27]. Fig (2) indicates that *S. lacustris* was the most abundant species among Naidid worms, while among tubificid worms (Fig3) *L. hoffmeisteri*, was the most abundant followed by *L. profundicola* and *S. sowerbyi*. In general *L. hoffmeisteri* and *B. sowerbyi* are the most abundant tubificid in Iraqi water surfaces, while *T. tubifex* always recorded in a low percentages [12,13,15]

According to [28] , the current study was recorded the species *Spirosperma ferox* (Eisen,1879) and *Pristinella jenkiniae* (Stephenson ,1931) as a new records to River Euphrates and the species *Bothrioneurum pyrrhum* (Marcur,1842) as a new record species to Iraq fauna .

Table (1) : Total Numbers of aquatic Oligochaetes (individual /m²) in study sites of Mid Sector of River Euphrates / Iraq for a period (Oct.2013- June.2014.)

Sites Month	S1	S2	S3	Monthly average
October2013	666.6	622.16	222.2	503.65
November2013	5421.67	3110.8	5510.56	4681.01
December2013	7243.68	4088.48	9865.98	7066.04
January 2014	7510.32	4932.84	9954.56	7465.90
February2014	7207.28	4355.12	6399.36	5987.25
March2014	5377.24	2710.84	4532.88	4206.98
April2014	3244.12	1866.48	3066.36	2725.65
May2014	2444.2	1199.88	2177.56	1207.21
June2014	1599.84	1199.88	1555.3	1118.34
Site Average	3689.40	2676.28	4809.418	

Table (2): Numbers of Aquatic Oligochaetes species Identified in study sites of Mid Sector of River Euphrates / Iraq

Family	Species	S1	S2	S3	Total	Percentages %
Naididae	<i>Stylaria lacustris</i>	21	14	14	49	2.01
Naidid worms Naidinae	<i>Slavina appendiculat</i>	-	-	4	4	0.16
Naididae	<i>Pristinella jenkiniae</i> **	10	-	-	10	0.42
Naidid worms Pristininae						
Naididae Tubificid worms	<i>Branchiura sowerbyi</i>	173	115	177	465	19.08
	<i>Bothrioneurum pyrrhum</i> *	7	-	-	7	0.28
	<i>Limnodrilus hoffmeister</i>	419	283	505	1207	49.55
	<i>L. profundicola</i>	171	104	196	471	19.34
	<i>L. udekemianus</i>	9	-	6	15	0.62
	<i>L. claparedeianus</i>	24	3	12	39	1.60
	<i>Spirosperma ferox</i> **	-	-	3	3	0.13
	<i>Tubifex tubifex</i>	3	2	3	8	0.33
Lumbricidae	<i>Eiseniella tetraedra</i>	65	21	72	158	6.48
Total		902	542	992	2436	
No. of species		10	7	10		

* New record for Iraq.

** New record for Euphrates River

Fig(1) : Oligochaet worms

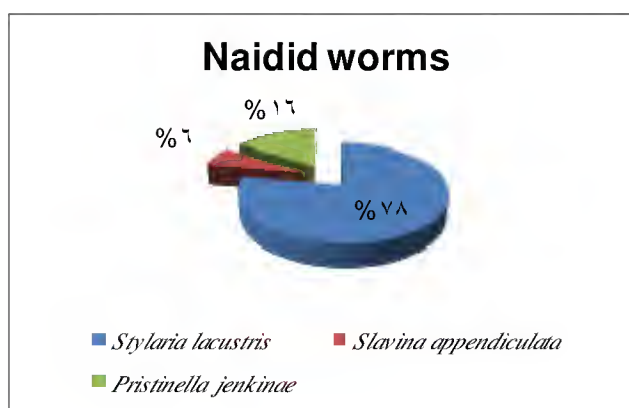
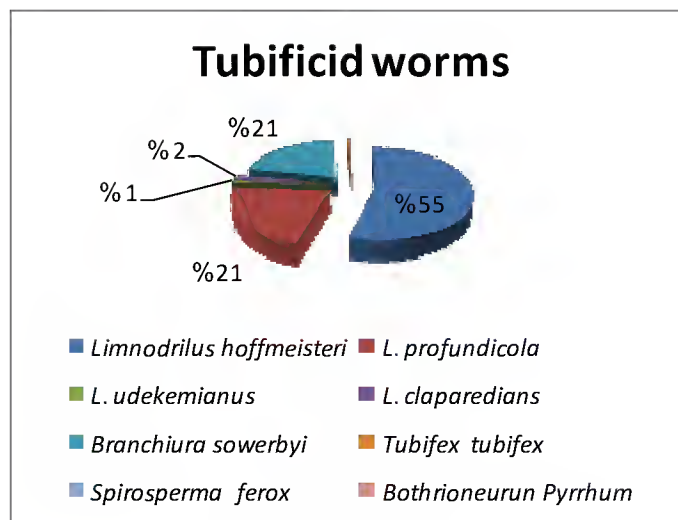


Fig (2): Naidid worms



Fig(3): Tubificid worms

References

- [1] Wetzel , M . J . , Kathman , R . D . , Fend , S . and Coates , K . A . Taxonomy , Systematic and Ecology of freshwater Oligochaeta . Work(Tubificidae) using cellulose substrate . *Aquaculture* , 2000, Vol. 40, No.1, pp.:89-94 .
- [2] Schwank, P. Turbellarien, Oligochaeten und Archianneliden des Breitenbach und anderer oberhessischer Mittelgebirgsbäche. III. Die Taxozonosen der Turbellarien und Oligochaeten in Fließgewässern – eine synökologische Gliederung. Schlitzer produktionsbiologische Studien (43–3). *Arch Hydrobiol Suppl* , 1982, Vol.62, pp.191–253.
- [3] Martinovic-Vitanovic , V., Djikanovic , V. , Obradovic, S. and Kalafatic , V. Composition and structure of the oligochaeta (Annelida) in Benthic Assemblages of the Danube River in the Belgrade region During May and October of 2004 . *Ekologia(Bratislava)* , 2007, Vol.26, No.2, pp. 174-189.
- [4] Martins, R.T., Stephan, N.N.C. and Alves, R.G. Tubificidae (Annelida: Oligochaeta) as an indicator of water quality in an urban stream in southeast Brazil. *Acta Limnol. Bras.*, 2008, Vol.20, No.3, pp.: 221-226.
- [5] Barbour, M.T., Gerritsen, J., Snyder, B.D., Stribling, J.B. *Rapid bioassessment protocols for use in streams and rivers: periphyton, benthic macroinvertebrates, and fish*. Second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. book prepared for North America Benthological Society Technical, 1999.

- [6] **Liu, Y., Vermaat, J.E., Ruyter, E.D. De Kruji, H.A.M.** Modification and application of biomonitoring ISO BMWP method of macrofauna in river pollution evaluation in China, *Acta Scientiarum Naturalium Universitatis Sunyatseni*, 2004, Vol.43, No.4, pp. 102-105.
- [7] **Timm, T.** A guide to freshwater oligochaeta and polychaeta of northern and central Europe. *Lauterbornia*, 2009, Vol. 66, pp. 1-23.
- [8] **Harman, W.J.** *Specific and Generic Criteria in Freshwater Oligochaete, With Special Emphasis on Naididae*. Aquatic Oligochaete Biology, Plenum press, New York and London, 1980.
- [9] **Al-Abbad, M.Y.M.** New records of *Pristine proposcidea* and *P. aquiseta* (oligochaetes : Naididae) from Iraq. *Marsh Bulletin*, 2010, Vol.5, No.2, pp.132-142.
- [10] **Al-Abbad, M.Y.M. and Al-Mayah, S.H.** New records of two species of oligochaetes (Naididae): *pristine longiseta* and *P. Macrochaeta* from Iraq, with note on their morphology and reproduction. *Mesopot. J. Mar.Sci.* 2010, Vol. 25, No.2, pp. 57-66.
- [11] **Jaweir, H.J.** A new record of three tubificid species (Annelida : Oligochaeta) from Al-Hawiezah marsh, Iraq. *Mesopot. J. Mar. Sci.* 2011, Vol. 26, No.2, pp. 114-121.
- [12] **Jaweir, H.J., Almukhtar, E.A. and Sebtie, H.A.** Aquatic Oligochaeta of Iraq's southern marshes. *Baghdad J. For Sci.*, 2012, Vol.10, No.1, pp.116-122.
- [13] **Jaweir, H.J. and Al-Janabi, E.S.O.** Biodiversity and abundance of aquatic oligochaetes- family Naididae in the middle sector of Euphrates river, al Al-Mussayab City/ Iraq. *The International Journal of the Environment and Water*, 2012, Vol. 1, No.1, pp.122-130.
- [14] **Jaweir, H. J. And Rhadi, M.M.** Naididae (Clitellata: oligochaeta) and Aeolosomstidae (Polychaeta: Aphanoneura) species associated with aquatic plants in Tigris River / Baghdad / Iraq. *J. Baghdad . Sci.* 2013, Vol. 10, No.1, pp. 116-125.
- [15] **Jaweir, H. J. And Alwan, A.M.** Sludge worms species (Oligochaeta: Naididae: Tubificinae) from different aquatic habitat in Baghdad /Iraq. *J. Baghdad . Sci.*, 2013, Vol. 10, No.2, pp. 269-281.
- [16] **Ali, L.A.** A study of macroinvertebrates communities in the middle sector of greater Zab River / Iraq . PhD. Thesis, College of Science for Women, University of Baghdad ,Iraq, 2007.
- [17] **Sabtie, H.A .** An ecological study of the benthic macroinvertebrates community in the Southern Marshes of Iraq. Ph.D. thesis, College of Science for Women , Baghdad University ,Iraq, 2009.
- [18] **Nashaat, M.R.** Impact of AL-Durah Power Plant effluents on physical, chemical and invertebrates biodiversity in Tigris River Southern Baghdad. PhD. thesis, College of Science, Baghdad University , Iraq, 2010.
- [19] **Brinkhurst R.O. and Jamieson B.G.M.** *Aquatic Oligochaeta of the World*. University of Toronto Press. Toronto., 1971, 860p.
- [20] **Chapman, P.M.** Utility and relevance of aquatic oligochaetes in Ecological Risk Assessment. *Hydrobiologia*, . 2001, Vol. 463, No. 1, pp.149-169.
- [21] **Schenkova, J. and Helesic, J.** Habitat preferences of aquatic Oligochaeta (Annelida) in the Roktná River, Czech Republic- a small highland stream. *Hydrobiologia*, 2006, Vol. 564, No.1, pp. 117-126.

- [22] **Lin, K.J. and Yo, S.P.** The effect of organic pollution on the abundance and distribution of aquatic oligochaetes in an urban water basin, Taiwan. *Hydrobiologia*, .2008, Vol. 596, No.1, pp. 213-223.
- [23] **Nijboer, R.C., Wetzel, M.J. and Verdonchot, P.F.M.** Diversity and distribution of Tubificidae, Naididae, and Lumbriculidae (Annelida: Oligochaeta) in the Netherlands: an evaluation of twenty years of monitoring data. *Hydrobiologia* , 2004, Vol. 520, pp. 127-41.
- [24] **Jaweir, H.J and Ibraheem, S.S.** Pollution Bioindicators in Al-Diwania River, Iraq . *J. of Um-Salama for Science*, 2004, Vol. 1, No.1, pp. 23-30.
- [25] **Millbrook, G.** An improved environmental index based on the relative abundance of Oligochaeta species . *Hydrobiologia* , 1983, Vol. 102, pp. 89-97.
- [26] **Casellato, S. and Caneva, F.** Composition and distribution of bottom oligochaete fauna of a north Italian eutrophic lake (Lake Ledro). *Hydrobiologia* ,1994, Vol. 278, pp. 87-92.
- [27] **Al-Kuti, S.S.I.** Use of annelid, oligochaeta as bioindicators in evaluating the pollution in Al-Dewania River. MSc. Thesis, College of Education, Univ. of Al-Qadisiyah, Iraq, 2000.
- [28] **Jaweir, H.J.** Checklist of Aquatic Oligochaetes Species in Tigris – Euphrates . In press, 2014.